REVIEW OF PRIORITIES IN SALINITY RESEARCH IN SASKATCHEWAN[1]

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INTRODUCTION

In 1985 the Associate Committee on Hydrology requested that the Land Resource Research Centre (Ottawa) prepare a state-of-the-art review paper on soil salinity. The objectives of this review paper were to assess the current needs for research into soil salinity and to highlight the role of hydrology in this research. The results of this review would be useful for managers and scientists to support development of appropriate research proposals so that funding agencies could be more informed as to the priorities and critical needs for research into dryland soil salinity. In response to this request, the Land Resource Research Centre established a Prairie Region Task Force to conduct this review.

The terms of reference given to the task force were as follows:

1. To review the relevant literature on soil salinity and the ongoing research activity in order to ascertain the nature and level of ongoing soil salinity research in Canada.

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2. To analyze the current research activity with a view to identifying the requirements for additional research and/or new initiatives which will contribute to a better understanding of the hydrological cause and effect relationships affecting soil salinity.
3. To prepare, for publication and broad circulation, a report or reports summarizing the findings in 1. and 2. above and making recommendations for research requirements.
4. To provide ACH with recommendations of agencies most likely to have competent personnel and the mandate to carry out the various research proposals.

To accommodate the first two terms of reference, the task force decided to undertake a poll-type survey of researchers and other interested and informed individuals involved in salinity, to ascertain what they perceived as the "critical" needs for research in soil salinity, and secondly to compile a list of recent and ongoing studies in soil salinity.

The objective of this paper is to report on the results of the prairie region questionnaire, with particular reference to the results of the Saskatchewan questionnaire.

METHODOLOGY

The questionnaire survey of research needs was conducted using a modified version of the Delphi Technique (Hunt and Brooks, 1982). The Delphi Technique was developed in 1950 at the Rand Corporation and has commonly been used in projective situations to assess future requirements.

The Delphi processes had been utilized in Alberta in 1984 to assess soil salinity research requirements. The Alberta questionnaire included most of the issues and concerns common to soil salinity across the prairies, the task force decided to adopt it for this prairie-wide assessment. Respondents were allowed to add some particular aspect of salinity that was not already identified.

Respondents were asked to rate each item on the questionnaire utilizing numbers 1 to 7 to indicate whether they considered the topic to be very critical (7), intermediate (6, 5, 4, 3, 2), or of little importance (1) with regard to research priorities. The respondents were given a specified time interval for completion and return of the questionnaire.

In total approximately 240 questionnaires were distributed across the prairies (97 Manitoba, 87 Saskatchewan, and 60-80 in Alberta). The distribution of salinity questionnaires in Saskatchewan is outlined in Table 1.

Table 1. Distribution of Salinity Questionnaire in Saskatchewan

Farmers	20
Saskatchewan Agriculture	16
PFRA	11
Saskatchewan Institute of Pedology	10
University of Saskatchewan	11
Agriculture Canada, Research Branch	8
Other Non-Government	7
Other Government	4
Total	87

Of the 87 persons that received the questionnaire, approximately 30% were involved directly in research while 20% were farming. A quarter of the questionnaires were sent to extension specialists. The remaining quarter were involved in salinity investigations that has components of both research and extension. Forty-eight questionnaires were returned for a response rate of 55% which is considered to be quite acceptable. Most respondents priorized all topics with additional topics included on many responses.

The questionnaire contained a list of 71 topics or subject areas grouped into the following 7 broad categories:

I Socio-Economic/Environmental
II Recharge Control
III Technology Transfer
IV Identification and Mapping
V Discharge Control
VI Discharge Control - Tile Drainage
VII Salt and Water Flux

RESULTS AND DISCUSSION

Analysis of the questionnaire consisted of determining the means and standard deviation for individual topics in each category. The overall mean for each category was determined from the means of each topic and the highest mean and lowest standard deviation were then used to rank the priority of categories within each province. The priority ranking for the prairie region was determined by taking the mean of each category for each province.

Preliminary analysis of the general priority ranking for the seven categories on a prairie region basis (Table 2)

indicated that Technology Transfer was the number one ranked priority. However, the Technology Transfer category contained only five topics, resulting in a means value that was disproportionately higher than that of the other categories.

Table 2. Priority Ranking of Categories by Province

Category	Overall Priority			
	Prairies	Man.	Sask.	Alta.
Technology Transfer	1	1	1	NR*
Identification and Mapping	2	2	5	1
Salt and Water Flux	3	4	3	4
Recharge Control	4	3	4	3
Discharge Control	5	6	2	5
Socio-Economic/Environmental	6	5	6	2
Discharge Control - Tile Drains	7	7	7	6

*NR - Not Rated in Alberta

Identification and mapping is the second priority for research in the prairie region, while the use of tile drains to control discharge is unanimously considered to be the lowest priority. There is a general consensus among respondents in each of the provinces that more research should be directed towards the areas of salt and water flux phenomenon and methods or techniques for controlling recharge. There is somewhat less agreement among the provinces as to the priorities for research in the Discharge Control and Socio-Economic/Environmental categories. These categories are ranked 5 and 6 respectively.

The results of the Saskatchewan questionnaire agree with the prairie perspective except in the case of Identification/Mapping and Discharge Control. In these areas,

the priorities are reversed, indicating a strong emphasis in Saskatchewan on dealing with salinity directly in the affected area.

In Saskatchewan, 20 of the 71 topics received a high rating (mean value greater than 5). Table 3 lists the top ten topics in order of rank.

Table 3. High Priority Research Topics in Saskatchewan

Rank	Topic
1	Development of salt tolerant crops
2	Establish practical field demonstration projects to show accepted salinity control mechanisms
3	Recropping versus alfalfa for recharge control
4	Impact of cropping practices on water table control
5	An integrated approach to reduce summerfallow recharge
6	Establish improved techniques to determine existing and potential recharge/discharge areas
7	Seeding and establishment techniques for crops in discharge areas
8	Crop/soil/climatic conditions that affect dryland recharge
9	Encourage the development and farmer operation of Dryland Salinity Control Associations
10	Impact of soil texture on vertical water movement within glacial soils

Seven of the top ten topics are concerned with identification and/or control of salinity in the affected area, while five are concerned with identification and/or control of recharge. A major point that was brought out in the study was the need for more detailed site specific investigations, in order to fully understand the causes of salinity and to be able to have effective control measures, this information must be available for use by the farmer through a demonstration program that has a high degree of farmer involvement.

It should be noted that three of the five individual topics in the Technology Transfer category were ranked high in both Saskatchewan and Manitoba. These were (ranking in brackets):

(2) Establish practical field demonstration projects to show accepted salinity control mechanisms.

(9) Encourage the development of farmer operated dryland salinity control mechanisms, and

(15) Broaden the approach to public and government education about salinity causes and controls.

This indicates that, even though these topics do not relate to soil salinity research per se, researchers should consider the dissemination and application of research findings as an integral part of their research program.

The second rated category, control of salinity in the discharge, had the most number of high priority topics.

(1) Development of salt tolerant crops;

(4) Impact of cropping practices on water table control;

(7) Seeding and establishment techniques for crops;

(11) Integrated and alternative reclamation techniques;

(12) Standardized method for testing and describing crop salinity tolerance;

(17) Critical crop-use groundwater salinity levels.

It is very important to develop cropping strategies for existing saline land and to develop use of saline groundwater.

Topics in the category, Salt and Water Flux, rated third in the Saskatchewan survey.

(10) Distribution variability and seasonal fluctuation of salts within affected areas;

(13) Movement of soil salt as affected by salt/water gradients;

(20) Parameters affecting salt concentration and removal.

There are basic research questions to answer regarding the distribution of salts both in space and time. Understanding the variability and the factors affecting mobility of salt are required to determine appropriate cropping strategies for salinity.

Addressing the salinity problem through Recharge Control was rated in the middle of the categories for priority although specific topics in this area had very high ratings.

(3) Management practices to reduce recharge;

(5) An integrated approach to reduce summerfallow recharge and facilitate affected area cropping.

(8) Crop/Soil/Climatic conditions that affect dryland recharge;

Research in this area should be directed to developing cropping strategies to reduce recharge.

Identification/mapping and diagnostic received a much lower rating in Saskatchewan that for the rest of the Prairies. Three topics were considered to have high priority:

(6) Established improved techniques to determine existing and potential recharge/discharge areas.

(14) Rate of salinity change within affected areas;

(16) Delineation shallow groundwater flow patterns.

Socio-Economic and Environmental issues received low priority in the Prairies including Saskatchewan. The only high priority topic was:

(18) Economic value of weedy salt tolerant plants.

This topic is directly related to the highest priority on development improved salt tolerant crops.

Research in Tile Drainage unanimously rated as low priority in Saskatchewan as well as the rest of the Prairies. The general indication is that tile drainage has little effect and low economic recovery in improving dryland salinity.

SUMMARY

This paper has presented the major findings of a poll-type survey of research needs and priorities for dryland soil salinity in Saskatchewan. Most respondents considered Technology Transfer and Discharge Control as very important categories. Discharge Control through tile drainage techniques was unanimously considered to be the least critical. From this general assessment of research priorities, it is apparent that:

1. Soil salinity is widely recognized as a water management problem. High emphasis was given to topics related to controlling discharge and to a lesser extent recharge.
2. Research should focus on water management through improved farming practices, that is, methods of water management utilizing appropriate crop selection and maintenance as

opposed to artificial drainage (i.e. tiles). Low priority was given to topics related to tile drainage, whereas high priority was assigned to topics related to development and selection of water efficient crops tolerant to salinity.

3. Basic research is still required to investigate soil-salt-water-plant relationships to improve our understanding of the natural processes involved and to facilitate the development and application of effective control measures. Geohydrology of salinized soils, improved field techniques for identifying, measuring and mapping salinity and numerous topics related to investigating salt and water flux phenomena within the soil were generally rated high.

4. Although technology transfer topics are not typically research problems per se, it is apparent that more public awareness is required to improve the recognition and management of soils affected by dryland salinity. Technology transfer topics were rated high priority in and Saskatchewan as well as the rest of the Prairies. Technology transfer includes the establishment of practical field demonstrations of known technology and establishment of farmer associations oriented towards salinity control. This requirement for more public involvement recognizes the fact that the magnitude of many salinity problems extend well beyond the control of individual farmers.

The final results of this survey will be utilized to assess the status and direction of current research into dryland soil salinity. It is also intended to be utilized as a reference in the planning and funding of future research projects for dryland salinity in the Canadian prairies.

REFERENCES

Hunt, S.L. and Brooks, K.W. 1982. The Delphi Technique: An Alternative to Haphazard Selection of Topics for Research. World Future Society Bulletin, March/April, 1982.

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